Claims

[c1] What is claimed is:

1. A method for avoiding deterioration of a dielectric characteristic of a dielectric layer having a low dielectric constant (low k) during a stripping process, the dielectric layer formed on a surface of a substrate, the method comprising:

performing surface treatment to the low k dielectric layer to form a passivation layer on a surface of the low k dielectric layer;

forming a patterned photoresist layer over the substrate;

using the photoresist layer as a hard mask to perform an etching process on the low k dielectric layer; and

performing a stripping process.

[c2] 2. The method of claim 1 wherein the substrate is a silicon substrate provided by a silicon wafer.

[c3] 3.The method of claim 1 wherein the low k dielectric layer is composed of HSQ (hydrogen silsesquioxane), MSQ (methyl silsesquioxane), H-PSSQ (hydrio polysilsesquioxane), M-PSSQ (methyl polysilsesquioxane), P-PSSQ (phenyl polysilsesquioxane) or HOSP.

[c4] 4. The method of claim 3 wherein the low k material is formed on the substrate by performing a chemical vapor deposition (CVD) process or a spin-on process.

[c5] 5. The method of claim 1 wherein the surface treatment is a plasma treatment.

[c6] 6. The method of claim 5 wherein the plasma treatment is performed in a nitrogen-containing environment to form the passivation layer on the surface of the low k dielectric layer.

[c7] 7. The method of claim 6 wherein the nitrogen-containing environment comprises nitrous oxide (N_2O), nitric oxide (NO), or ammonia (NH_3).

[c8] 8. The method of claim 6 wherein the plasma treatment utilizes a radio frequency (RF) with a power of about 100 to 300 Watts (W), a process pressure

between 10^{-3} and 10^{-6} Torr, a process time of less than 20 minutes, and a process temperature of the substrate that is less than 250 ° C.

[c9] 9. The method of claim 1 wherein the stripping process is a wet stripping process, and the passivation layer is used to avoid formation of Si-OH bonds in the low k dielectric layer during the wet stripping process.

[c10] 10. A method for avoiding deterioration of a dielectric characteristic of a low k dielectric layer, the low k dielectric layer formed on a substrate, the method comprising:

performing a surface treatment to the low k dielectric layer to form a passivation layer on a surface of the low k dielectric layer;

forming a patterned photoresist layer over the substrate;

using the photoresist layer as a hard mask to perform an etching process to the low k dielectric layer; and

performing a wet stripping process;

wherein the passivation layer is used to inhibit the formation of Si-OH bonds that absorb moisture in the low k dielectric layer during the wet stripping process to avoid deterioration of dielectric characteristics of the low k dielectric layer.

[c11] 11. The method of claim 10 wherein the substrate is silicon substrate provided by a silicon wafer.

[c12] 12. The method of claim 10 wherein the low k dielectric layer is composed of HSQ hydrogen, MSQ, H-PSSQ, M-PSSQ, P-PSSQ or HOSP.

[c13] 13. The method of claim 12 wherein the low k material is formed on the substrate by performing a chemical vapor deposition (CVD) process or a spin-on process.

[c14] 14. The method of claim 10 wherein the surface treatment is a plasma treatment.

[c15] 15.The method of claim 14 wherein the plasma treatment is performed in a

nitrogen-containing environment to form the passivation layer on the surface of the low k dielectric layer.

[c16] 16. The method of claim 15 wherein the nitrogen-containing environment comprises nitrous oxide (N_2O), nitric oxide (NO), or ammonia (NH_3).

[c17] 17. The method of claim 16 wherein the plasma treatment utilizes a radio frequency (RF) of the plasma treatment having a power of about 100 to 300 Watts (W), a process pressure that is between 10^{-3} - 10^{-6} Torr, a process time that is less than 20 minutes, and a process temperature of the substrate that is less than 250 ^{o}C.